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Hemodialysis Disparities in African Americans: The Deeply Integrated Concept of Race in the Social Fabric of our Society

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Abstract

End-stage renal disease (ESRD) is one of the starkest examples of racial/ethnic disparities in health. Racial/ethnic minorities are 1.5 to nearly 4 times more likely than their non-Hispanic White counterparts to require renal replacement therapy (RRT), with African Americans suffering from the highest rates of ESRD. Despite improvements over the last 25 years, substantial racial differences persistence in dialysis quality measures such as RRT modality options, dialysis adequacy, anemia, mineral and bone disease, vascular access, and pre-ESRD care. This report will outline the current status of racial disparities in key ESRD quality measures and explore the impact of race. While the term race represents a social construct, its association with health is more complex. Multiple individual and community level social determinants of health are defined by the social positioning of race in the U.S., while biologic differences may reflect distinct epigenetic changes and linkages to ancestral geographic origins. Together these factors conspire to influence dialysis outcomes among African Americans with ESRD.

Keywords

Race; disparities; dialysis; end-stage renal disease; African American; Black; social determinants

“Few people are capable of expressing with equanimity opinions which differ from the prejudices of their social environment.” – Albert Einstein

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Multiple aspects pertaining to end-stage renal disease (ESRD) are among the starkest examples of the disparities which exist between healthcare delivered to racial/ethnic minorities and that delivered to non-minority populations in the United States (US).(1, 2) This is reflected in part by the incidence rate of ESRD which affects US minorities from 1.5 to nearly 4.0 times more than age-adjusted non-Hispanic White counterparts, with African Americans (or Blacks) suffering from the highest rates.(3, 4) There is also extensive data outlining racial differences in ESRD quality measures such as renal replacement therapy (RRT) modality options, dialysis adequacy, anemia, mineral and bone disease (MBD), vascular access, pre-ESRD care and hospitalizations. This report will outline the current status of racial disparities in key ESRD quality measures and explore the potential impact of race as primarily a social determinant of health with a lesser contribution from biologic differences that conspire to influence health outcomes among African Americans with ESRD. There will also be a discussion of the impact of race at the community level that affects ESRD outcomes.

The elimination of racial and ethnic disparities in all stages of CKD is becoming widely recognized in the field of nephrology as an important initiative to improve overall patient outcomes,(1, 5–7) and is a highlighted target for Healthy People 2020, our nation's blueprint for health.(8) The earlier recognition of increased rates of ESRD among African Americans in the late 1970s and early 1980s(9–11) spawned interest in ESRD disparities in the early 1990's(12, 13) and underscored the need to better understand the issues underlying both ESRD incidence and quality of care for racial/ethnic minorities, women and other disadvantaged groups receiving RRT.(13–15) In response to these earlier findings over two decades ago national ESRD performance measures and quality standards were introduced which led to a substantial reduction in dialysis-related disparities and to progressive improvement in the quality of care for all dialysis patients;(16, 17) however, much work remains.

In evaluating kidney disease-related racial disparities it is critical that we concurrently view this topic through two distinctly different lenses, one viewing race as a social construct and one as select biological differences. Thus, the role of social determinants of health juxtaposed with an array of geo-evolutionary risk and resilience genes may conspire differently in varying settings to influence outcomes for patients along the spectrum of chronic kidney disease (CKD). It is important that the nephrology community have an in-depth understanding of both the present state of affairs in regards to the quality of pre-ESRD and ESRD care for patients on dialysis and an appreciation of how socio-cultural and biologic implications of race influence clinical outcomes. Through this understanding, we can move closer to creating more effective solutions to eliminate disparities.

ESRD Treatment Modalities

Despite a similar prevalence of the early stages of CKD, African Americans are 3–4 times more likely than their non-Hispanic White counterparts to progress to ESRD and require RRT.(3, 4) In the U.S. the preferred options of RRT are kidney transplantation or home dialysis, with in-center hemodialysis being less desirable (although remaining the most common form of RRT).(18) Yet, Black ESRD patients are less likely to receive RRT with

either a kidney transplant or home dialysis therapy. In 1991 compared with White patients with ESRD, Black patients with ESRD were 42% less likely to have a functioning kidney transplant, 28% less likely to be treated with peritoneal dialysis and 45% less likely to be treated with home hemodialysis.(19)

These disparities in ESRD treatment modalities have changed very little over the last 20 years. In 2016 Mehrotra et al. reported in an adjusted analysis of over 160,000 patients who initiated maintenance dialysis within a single large dialysis organization, and found that compared to Whites, African Americans were still 60% less likely to be treated with home hemodialysis and 47% less likely to be treated with peritoneal dialysis. These findings highlight the need for continued efforts to achieve greater equity in the use of the preferred options for ESRD care among African Americans.

Dialysis Adequacy

Large racial disparities in dialysis adequacy were also noted over twenty years ago when Frankenfield et al. reported that compared to Whites, African Americans were 40% more likely to have suboptimal dialysis adequacy as defined by a $Kt/V < 1.2$.(20) Fortunately there has been a major reduction in the racial disparities of dialysis adequacy following a national effort in 1994 spearheaded by the Health Care Financing Administration (now Centers for Medicare & Medicaid Services or CMS) ESRD Health Care Quality Improvement Program (HCQIP) to improve the quality of ESRD care.(17, 21, 22)

This approach which included the mandatory facility reporting of dialysis quality of care metrics was further reinforced in the mid 1990s by the CMS ESRD Continuous Performance Measures (CPM)(23) based on the National Kidney Foundation (NKF) Kidney Disease Outcomes Quality Initiative (KDOQI) guidelines.(24) These programs have concurrently advanced equity in the treatment of dialysis patients through physician accountability and eliminated the need for initiating race-based interventions to address disparities in dialysis adequacy.(17)

As a result of these initiatives, data from a 2015 report of Kt/V for patients on dialysis for at least 1 year who underwent dialysis 3 times per week found a mean Kt/V of 1.6 for non-blacks and 1.5 for Blacks in 2010 and a mean Kt/V 1.6 for both in 2011.(25) While the CMS ESRD CPM and ongoing quality improvement measures have eliminated dialysis adequacy-related racial disparities on an individual level, disparities have recently been reported at the facility level with a lower level of dialysis adequacy reported in patients treated in dialysis facilities within neighborhoods with a higher proportion of African Americans. This inequity persists even after controlling for neighborhood socioeconomic status and other factors in some,(26) but not all studies(27). Findings such as these reinforce the need to better understand and further explore the driving factors for disparities at individual and particularly at facility/community levels in order to further advance efforts to achieve equity in treatment adequacy at dialysis facilities regardless of location or patient case-mix.

Anemia

Twenty years ago, at the time of the introduction of CMS performance measures, compared to White prevalent hemodialysis (HD) patients, African American prevalent HD patients were 20% more likely to have serum hemoglobin (Hb) levels < 10g/dl, the lowest recommended level for dialysis patients.(20) What has not been commonly appreciated is that in the general(28) and early CKD populations African Americans have approximately 0.5g/dl lower adjusted mean Hb levels than Whites.(29, 30) This may be due not only to nutritional deficiencies but to variant hemoglobin phenotypes(31, 32) and/or higher rates of inflammation.(33) Therefore, not unexpectedly, African Americans have both lower Hb levels at the initiation of dialysis (9.3 g/dl compared to 9.7 g/dl for White patients(3)), as well as greater requirements of erythropoiesis-stimulating agents (ESAs) to achieve similar target Hb levels on maintenance hemodialysis.(31, 34)

Since the implementation of the KDOQI initiative and the CMS CPM program in the 1990's,(17) there has been a dramatic improvement in the percent of African American patients on RRT who have achieved target Hb levels. There had been concern that any positive impact resulting from these initiatives would have been negated by the implementation of the 2011 Medicare ESRD prospective payment system (PPS) and the simultaneous FDA-mandated manufacturer label changes to lower recommended Hb targets, each of which could have led to more restricted ESA use, increased rates of anemia and subsequently worse outcomes.(35, 36) This had been of particular concern for Black patients given the historically higher ESA use needed to maintain parity in Hb levels. But a 2015 report of over 7000 maintenance hemodialysis patients at 132 facilities from the Dialysis Outcomes and Practice Patterns Study (DOPPS) Practice Monitor by Turenne et al., found that, while overall mean Hb levels fell from 11.5 to 11.0 g/dl and mean EPO dose declined from 20,506 to 14,777 U/wk, no meaningful differences by race were observed.(25)

An interesting analysis by Wang et al, was also completed following the PPS and ESA labeling changes in 2011. They found no difference in cardiovascular outcomes among White fee-for-service Medicare patients on dialysis 66 years or older during the two year period before and after the PPS and ESA changes while an 18% reduction in cardiovascular events was observed in Black patients. Such findings suggest that different target ESA and Hb levels may be appropriate for Black dialysis patients.(37)

Thus, while anemia management and regulatory practices have changed significantly over time, there has been no evidence of any resulting anemia-related racial disparities among individual patients,(25) with the one possible exception of improved cardiovascular outcomes for Black patients.(37) One study did suggest that anemia-related disparities still persist at a facility level, reflected in a lower rate of achievement of targeted Hb levels in patients treated in facilities in neighborhoods with a higher proportion of African Americans.(26) Interestingly, when facility level Hb targets are examined by the percentage of African Americans patients per facility (rather than by neighborhood) there was no influence on anemia related quality measures.(27) This highlights the likely importance of social determinants at a community level. The factors influencing the persisting anemia disparities in African American dominant neighborhoods, and the finding of decreased

mortality rates among African Americans with lower ESA use and lower Hb targets need to be further explored.

Mineral and Bone Disorders (MBD)

Recommended targets for intact parathyroid hormone (iPTH) levels in patients with CKD were established by the 2003 report of the K/DOQI Clinical Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease(38) and subsequently implemented as part of the CMS dialysis quality measures. Achievement of recommended targets has been less successful among African Americans, compared to Whites, likely secondary to African Americans' lower baseline 25(OH)D levels and higher iPTH levels with or without renal dysfunction. Blacks with ESRD consistently require higher and more frequent doses of activated vitamin D and cinacalcet.(25) This persisting disparity was reported in 2010 by Kalantar et al, approximately 15 years after introduction of the CMS measures, when 139,328 thrice-weekly treated hemodialysis patients (32% Black) were evaluated for up to 60 months and Black patients were found to have higher iPTH and calcium levels compared to non-Blacks, while serum phosphate and alkaline phosphate levels did not differ.(39) Blacks with advanced CKD(40) and ESRD(41, 42) also have lower levels of fibroblast growth factor 23 (FGF-23), another important contributor to mineral metabolism and clinical outcomes in renal disease.

These disparate findings regarding MBD risk factors, may however be associated with both positive and negative health consequences. While hypovitaminosis D has emerged as a potential independent risk factor for all-cause and cardiovascular mortality,(43) a 1999 report noted that in the presence of increased iPTH levels there was increased bone mineral density among African American compared to White dialysis patients,(44) while a 2000 report noted reduced fracture rates among Black dialysis patients,(45) an observation that persists.(46, 47) Also higher levels of iPTH in Blacks with ESRD leads to an increased incidence of hyperparathyroid bone disease in contrast to their White peers who may be at increased risk for the perhaps equally serious condition of adynamic bone disease due to lower iPTH levels.(48, 49) Most significantly, both Wolf and colleagues and Kalantar et al. found that among different dialysis cohorts there was a demonstrably greater likelihood for survival in Black dialysis patients who received higher doses of activated vitamin D compared with those who either received lower doses or no active vitamin D, while survival in White patients did not significantly vary with paricalcitol use.(39, 49)

Lower FGF-23 levels appear to impart an added survival advantage to Blacks patients on dialysis.(41) A stratified analysis of mortality by FGF-23 levels and race in 400 dialysis patients revealed a 60% lower risk of death in Black versus White patients in the cohort below the population median of FGF-23 levels while there was no Black-White mortality difference in the cohort above the population median.(41) Following the implementation of 2011 cost-saving measures by the Medicare ESRD PPS Turenne et al. reported mean serum iPTH increased from 340 to 435 pg/ml, but found no meaningful differences by race.(25)

In sum, these findings suggest that MBD and the effects of their treatment may differ between Blacks and Whites, and may partly account for the observed differences in survival

between Black and White hemodialysis patients. Whether these differences in morbidity and mortality seen in African Americans are a consequence of the intrinsic baseline differences in indices of bone and mineral metabolism or due to the resultant more aggressive indicated treatment, requires further analysis to elucidate these Black-White MBD related differences in ESRD patients.

Vascular Access

While superior clinical outcomes have long been established for patients who begin hemodialysis treatment with a working arteriovenous fistula (AVF), starting hemodialysis with a functioning vascular access remains one of the major lingering areas of racial and gender disparities in the dialysis population.(50, 51) Despite the early KDOQI Vascular Access Guidelines recommending targeting fistula rates of 40% or greater for incident dialysis patients,(52) and more recent guidelines targeting even higher rates,(53) significant disparities persist.

In a 2015 analysis of over 650,000 patients initiating hemodialysis, Nee et al. found African Americans were still significantly less likely to have an AVF even after adjusting for clinical and socioeconomic factors including insurance status and neighborhood poverty.(54) Likewise, in a cohort of nearly 400,000 patients in the United States Renal Data System (USRDS), Zarkowsky and colleagues also found in 2015 that Black patients and Hispanic patients continued to initiate hemodialysis with an AVF less frequently than non-Hispanic White patients, despite being younger and having fewer comorbidities, regardless of insurance status.(55) When the analysis stratified Black patients based on either insurance status or whether they had been followed by a nephrologist for over a year prior to the initiation of HD, they were respectively 10% and 19% less likely to start HD with an AVF compared to their non-Hispanic White peers.(55) The strong association between Black race and lower AVF placement also continues to be seen in older ESRD populations who frequently are covered by Medicare insurance,(50) and persists after adjustments for multiple clinical and socioeconomic factors.(50, 54–56) This therefore represents yet another parameter that begs further evaluation to elucidate possible solutions to eliminate these disparities.

Pre-ESRD Nephrologist Care

Pre-ESRD care is linked to several other ESRD quality care indicators such as anemia and vascular access, and the lack of or delay in establishing pre-ESRD care is associated with increased risk of death following transition to RRT.(57–59) Unfortunately there has been little change over the last 15–20 years in the higher rate of delayed or no pre-ESRD nephrology care for Black patients compared to Whites.(57–61) Despite the introduction of the ESRD quality care initiatives in the early 1990s, a 2015 report from Gillespie and colleagues found that at baseline African Americans were still less likely than Whites to have received any pre-ESRD care (31% vs. 38%), and less likely to have seen a nephrologist more than 12 months prior to initiating dialysis (24% vs. 30%).(58) Further, after multiple statistical adjustments including insurance coverage and region of care, African Americans

were 34% less likely than Whites to have >12 months of pre-ESRD nephrology care versus no care.(58)

These findings are reinforced by an analysis of interstate variation in nephrologist pre-ESRD care for nearly 375,000 adult USRDS patients that found the average state-level probability of having received nephrologist care 12 months prior to dialysis was lower in Blacks, especially in the younger Black subpopulation,(62) and attenuated for older Blacks, who were more likely to have Medicare insurance coverage prior to RRT.(62) This highlights insurance as a major driver for racial disparities in the pre-ESRD period, although not the sole influence as the disparities persisted even after adjusting for differences in insurance coverage. Therefore, like vascular access, further investigation into any potential underlying factors that could account for these disparities such as medical mistrust, health literacy, provider and patient biases, health system barriers, social determinants and others should be pursued.(6, 55, 63–65)

Survival for African Americans on Dialysis

Despite the outlined inequities in the quality of ESRD care, epidemiologic data have consistently shown that various racial and ethnic minorities treated with dialysis have greater survival rates than their peer majority groups even after adjusting for transplantation.(66–75) The observation that minority racial/ethnic groups on dialysis have greater survival than their majority peers is not limited to the U.S, but has also reported elsewhere including Israel and Denmark.(71, 73, 76) In the U.S. the Black-White survival difference appears to vary by age as there are significantly better survival rates for Blacks above 40 or 50 years of age compared to Whites, but younger Black and White patients have similar survival rates.(67, 68, 70)

Our understanding of the impact of community characteristics on survival in dialysis patients is more limited. When Kalbfleisch et al. computed standardized mortality ratios (SMRs) for patient race in nearly 6000 U.S. dialysis facilities without adjustment, it was found that facilities with higher proportions of Black patients had better survival outcomes.(77) However, after adjusting for racial differences within each facility, facilities with higher proportions of Black patients had poorer survival outcomes among both Black and non-Black patients.(77) This trend was corroborated by Hall et al. who also found that dialysis facilities treating predominantly racial/ethnic minority patients exhibited worse than expected patient survival.(27) Further, dialysis facilities located in neighborhoods with a higher proportion of African American residents were also found to have worse survival rates.(26, 78, 79)

These findings indicate that although Black race may confer a better survival rate on dialysis at an individual level, this survival benefit could be dissipated by receiving dialysis care at a facility which either treats predominantly minority patients or is located in a community with predominantly minority residents. This highlights the powerful moderating effect of socioeconomic status and contextual influences (i.e., practice patterns and community/environmental resources). Indeed, when we examined all cause mortality by race/ethnicity of patients with equal access to care in the U.S. veterans health system we found increased

adjusted survival rates for African Americans compared to their White peers, in contrast to lower adjusted survival rates reported in the general population.(80, 81) What accounts for the survival benefits of Blacks on dialysis or the inequities in ESRD and pre-ESRD care is unclear, but these findings of the intertwined social and economic influences have important implications for patient outcomes as well as the CMS rating of facility outcomes.

DEFINING RACE

While the concept of race is deeply integrated into the social fabric of our society, there is no generally agreed upon definition for the term. DNA analyses suggest there are no distinct, discrete, identifiable populations by race in modern *Homo sapiens*.(82) The term race carries complex nuances that reflect culture, history, socioeconomics, and political status, juxtaposed with differing frequencies of particular genetic variants that reflect important linkages to ancestral geographic origins.(83) Thus, while race is not a defined biologic entity, it is not strictly true that race has no biological connection.(83)

The current categorization system of race derives from four major subsets of humans originally proposed by Francis Bernier in 1684,(84) and subsequently configured into a more socially-constructed hierarchal set of groupings by Carl Linnaeus in the 1700s in his treatise, *Systema Naturae*.(85) Linnaeus associated select personality traits, skills, and abilities,(85) to the four racial categories (European, Native American, Asian, and African) establishing a perceived “scientific” foundation that race is the primary determinant of human traits and capacities, and implying that there may be an inherent superiority of a particular group”.(86) These original racial designations differ little from the major racial groups used today by the U.S. Office of Management and Budget (OMB), the department which governs census reporting, and include the original categories -White, American Indian or Alaska Native, Asian, and Black or African American - with a fifth category, Native Hawaiian or Other Pacific Islander added in 2000.(87–89) The OMB has also added two major ethnic categories for each person, Hispanic or Latino, and not Hispanic or Latino.(87, 88) Similar to race, the categorization of ethnicity was founded on socio-cultural and linguistic characteristics, and has no solid scientific basis,(90, 91) although select ancestral biologic linkages may exist. It is important to mention that these designations are embedded in a European world-view and the norms that follow through that lens would likely differ if viewed through another cultural lens.

Therefore it is not surprising that health outcomes stratified by race and ethnicity are less likely a result of biology and more strongly influenced by one’s social position and the associated socio-ecologic determinants of health such as: discrimination, residential segregation,(92) educational and income inequalities,(93–96) imbalance in community level assets, access to care,(5) health care resources,(78, 97, 98) and exposure to environmental toxins.(6, 99) Additional factors include health system barriers, unconscious provider bias, stereotype threat, medical mistrust, and patient beliefs and behaviors.(63, 65, 100, 101) Stereotype threat is a more recently recognized concept in healthcare and refers to the fear of being judged by, and/or of personally confirming through one’s own actions, negative group stereotypes that operate within the domain of healthcare, including inferior intelligence,

lower status, greater likelihood of engaging in risky behaviors, and being less deserving of the highest standard of care.(101)

Thus the term “race” and its influence on health outcomes seems to most accurately represent a collection of people organized around shared ancestry and history, shared cultural norms and language, and social identity as well as shared biological characteristics driven by epigenetic changes and/or geo-evolutionary pressures that have led to differing prevalences of select gene polymorphisms (Figure 1).(83, 102, 103) This socio-biologic construct may allow us to more accurately characterize and explore the many factors which account for the disparities in ESRD parameters and measured targets.

Discussion

Both social and biological factors appear to contribute to the more frequent need for RRT for African Americans where access to and quality of care, patient behaviors, control of risk factor conditions and others combine with CKD risk alleles to have major influences on CKD development and progression.(2, 63) Once progression to ESRD has occurred, the impact of the dual roles of social and biologic factors may vary substantially for different quality measures and outcomes.

The impact of social positioning by race and associated financial and sociocultural barriers appear to heavily influence persistent disparities in the likelihood of receiving different forms of RRT, pre-ESRD care and AVF placement.(1, 5, 6),(64, 93, 97) In terms of finances, inadequate health insurance and other access barriers to care are likely to contribute substantially to African American patients’ less frequent receipt of pre-ESRD care, reduced access to vascular surgery and therefore less timely AVF placement and maturation, more frequent inadequate home and/or social support or difficulties navigating the complex multi-disciplinary protocols required to transition to home dialysis modalities or attain a renal transplant.(104–106) Further, sociocultural factors such as unconscious provider biases may result in differential clinical practice decision-making, while medical distrust and related factors influence patients’ beliefs and behaviors further reducing African Americans’ likelihood to receive appropriate care and achieve equitable clinical outcomes.(63, 107)

By contrast, biologic variations related to ancestral polymorphisms appear to also influence disparities in CKD risk and ESRD treatment and outcomes. The effort to understand potential biologic underpinnings of CKD has led to the recognition of increased prevalence of sickle cell disease/trait(108) and select Apolipoprotein L-1 (APOL 1) alleles as CKD risk factors in persons of African descent,(109, 110) while oxidative protective alleles (e.g. glutathione-S-transferase-m1 or GSTM1)(111) and others,(112) have been identified as potential resilience factors.

Further, genetic factors such as differing distribution of melanin and vitamin D binding protein polymorphisms(113, 114) may help explain the racial differences noted in the vitamin D-PTH axis which likely contribute to disparities in the incidence of MBD and associated outcomes among different racial groups affected by ESRD. Similarly Hb variants may contribute to disparities in anemia management, including the need for higher doses of

therapy and therefore increased costs to achieve recommended goals. There also is evidence that worse AVF placement outcomes may be related to the potential adverse impact of higher ESA dosing or gene polymorphisms on AVF maturation,(115) and/or racial differences in vascular anatomy.(116)

Factors which underlie the surprising finding that African Americans on dialysis have better adjusted survival rates than Whites,(69, 72, 117) remain incompletely explained and raise important questions about possible mechanism(s). Reasons for this observation may include survival bias which refers to variations in the health of Blacks and Whites who survive to dialysis; psychosocial resilience; and permissive or effect-modifying biologic related resilience that may be expressed in a chronic disease state such as dialysis.(69, 98, 112, 118, 119) This enhanced survival on dialysis, however, does not extend to younger Black patients, which may reflect higher rates of homicide, motor vehicle accident, suicide, drug overdose and/or other community level factors.(69, 117, 120) Findings of attenuation of the survival bias among patients receiving care in low resource neighborhoods draw continued attention to the seemingly substantial contribution of contextual social determinants on the health of African American dialysis patients. Our task is to exploit those factors influencing disparities to create effective interventions and policies to achieve the goal of health equity for all patients.

Implications for ESRD Policy

The overwhelming impact of race as a dual social construct and as a marker of biologic ancestral diversity on the health of patients on dialysis cannot be ignored in creating effective solutions. Importantly, as we identify disparities and/or differences between racial groups, the lessons learned should lead not only to new biomedical advances including personalized medicine but also to new social and health policy changes that will improve outcomes for all populations.(121, 122) In addition to policies funding research to identify targeted approaches to improve treatment, health policies are critical to address access to, and quality of, care and community social care factors as health is heavily influenced by where people live, labor, learn, play, and pray.(123)

There are numerous potential unintended adverse consequences related to current efforts to regulate the quality of dialysis treatment. Section 153(c) of the Medicare Improvements for Patients and Providers Act (MIPPA) of 2008 directs the Secretary of Health and Human Services (HHS) to develop a method to assess the quality of dialysis care provided by facilities and to link this performance to payment. Facilities which fail to meet this performance standard may receive a payment reduction of up to two percent.(124) While many ESRD quality measures have improved for African Americans compared to 20 years ago due to improved regulation, many still lag behind measures for non-Hispanic Whites, especially when viewed on a facility or neighborhood level.(26, 78, 79) Reimbursement based on facility level performance raises concerns that facilities in low-income communities, often comprised of a disproportionately high percentage of racial/ethnic minorities, may be adversely affected.(125) Such reimbursement policies could lead to selective removal of patients from facilities (cherry picking), depriving minority patients of the best quality care. Large dialysis organizations could also elect to not locate facilities in

low income and predominately Black neighborhoods further compromising access to dialysis care. Confounding these concerns is the fact that the cost of care for long-term dialysis patients by race is nearly 10% greater for African Americans (cost for anemia and MBD medications) after accounting for other factors.(126) The pay for performance policy adopted by CMS therefore has the potential to adversely affect the delivery of care to certain populations, especially in facilities treating high percentages of Black patients that must balance higher costs, less favorable insurance mix, and worse clinical outcomes leading to a greater likelihood of a facility being penalized. Inclusion of self-reported or neighborhood race into a PPS should be considered,(126) but may require a better understanding of known biological differences such as MBD and anemia outcomes, and modeling of the social effects that influence neighborhoods.

Conclusion

The root causes of dialysis related racial disparities are complex, and stem from race being not only an indicator of sociocultural status but also a proxy for ancestral biologic variation. Thus there are two broad lenses through which racial disparities may be viewed. Efforts to attribute disparities in quality metrics and clinical outcomes should directly address which aspects of race (i.e., social or ancestral) are most plausibly implicated and should target cause(s) appropriately.

While there have been improvements in Black-White disparities in several dialysis quality measures (e.g. adequacy, anemia), especially at an individual level, several areas such as RRT options, AVF placement and neighborhood level disparities in dialysis quality measures persist. Strategies such as patient and family level shared decision-making may help patients make more informed decisions about their treatment options for RRT.(127, 128) At the same time we must continue to advocate for the social level changes that can promote equity while ensuring the highest quality of care within our health systems and dialysis facilities. We must advocate for policies that address the social determinants of health coupled with thoughtful assessment of care elements that might be influenced by biology to continue to narrow the Black-White gap in dialysis quality measures and ultimately to achieve health equity and improve outcomes for all patients.

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Figure 1. Interconnections between race/ethnicity and health status. Adapted by permission from Macmillan Publishers Ltd: *Nature Genetics* 36(11 Suppl):S13–5, copyright (2004).(83)

Table 1

Summary of existing state of Black-White Disparities for Patients treated with Dialysis

Key Dialysis Measures of Interest	Black-White Disparity
Renal Replacement Therapy Modality Options	Black patients are less likely to be treated with peritoneal dialysis, home hemodialysis, transplantation or palliative care
Dialysis Adequacy	Black patients now have similar levels of dialysis adequacy, but facilities in neighborhoods with high numbers of Blacks have worse measures of dialysis adequacy
Anemia	Black patients now have similar levels of anemia while they require higher doses of erythropoietin stimulating agents. Facilities in neighborhoods with high numbers of Blacks have worse measures of anemia
Mineral And Bone Disease	Black patients now have similar levels of mineral and bone disease measures they require higher doses of activated Vitamin D and cinacalcet. Facilities in neighborhoods with high numbers of Blacks have worse measures of mineral and bone disease
Vascular Access	Black patients are less likely to receive placement of an arteriovenous fistula prior to first ESRD dialysis treatment
Pre-End-Stage Renal Disease Care	Black patients are less likely to receive pre-ESRD nephrology care
Survival in Dialysis	Black patients are more likely to survive on dialysis despite suffering from lower rates of several markers of quality dialysis care.

Table 2

Summary of key dialysis measures and the corresponding potential socioecologic and biologic determinants

Key Dialysis Measures of Interest	Potential Socio-Ecologic Determinants	Potential Biologic Determinants
ESRD Incidence	<ul style="list-style-type: none"> - Limited insurance status and low SES, limited family and health care resources, patient medical mistrust, healthcare health beliefs and behaviors, stereotype threat, - Unconscious provider bias - Health system barriers - Poor control of ESRD medical risk factors - Excess exposure to environmental toxins 	Increased prevalence of sickle cell disease/trait, APOL1 CKD risk alleles and other (e.g. epigenetic changes)
RRT Modality Options	<ul style="list-style-type: none"> - Limited insurance status and low SES, limited family and health care resources, patient medical mistrust, healthcare health beliefs and behaviors, stereotype threat - Unconscious provider bias - Health system barriers 	Unlikely
Vascular Access	Insurance status (especially pre-ESRD), health beliefs and behaviors	Possible differences in vessel size and structure, higher ESA dosing may adversely affect fistula maturation
Dialysis Adequacy	Unconscious bias, health beliefs and behaviors	Unlikely
Anemia	Insurance status to pay for iron and erythropoietin stimulating agent therapies	Increased prevalence of variant hemoglobins (Lower mean hemoglobin in general population)
Mineral And Bone Disease	Insurance status to pay for phosphate binders and activated Vitamin D therapies	Increased prevalence of select vitamin D binding protein polymorphism and other (Lower mean 25(OH)D and disproportionately higher intact parathyroid hormone levels in general population)
Pre-ESRD Care	Unconscious bias, medical mistrust, insurance status (especially pre-ESRD), health system barriers, health beliefs and behaviors, healthcare stereotype threat	Unlikely
Survival in Dialysis	Psychosocial resilience	Permissive or effect-modifying biologic related resilience (e.g. protective polymorphisms for stress [glutathione-S-transferase-m1] or survival [FoxO3 gene])